

The Stanford Nutrition Action Program: A Dietary Fat Intervention for Low-Literacy Adults

ABSTRACT

Objectives. This study was undertaken to test the effectiveness of the Stanford Nutrition Action Program, an experimental trial to reduce dietary fat intake among low-literacy, low-income adults.

Methods. Twenty-four paired adult education classes (351 participants, 85% women, mean age = 31 years) were randomly assigned to receive a newly developed dietary fat curriculum (the Stanford Nutrition Action Program) or an existing general nutrition curriculum. Food frequency and nutrition-related data, body mass index, and capillary blood cholesterol were collected at baseline and at two postintervention follow-ups.

Results. The Stanford Nutrition Action Program classes showed significantly greater net improvements in nutrition knowledge (+7.7), attitudes (+0.2), and self-efficacy (+0.2) than the general nutrition classes; they also showed significantly greater reductions in the percentage of calories from total (−2.3%) and saturated (−0.9%) fat. There were no significant differences in body mass index or blood cholesterol. All positive intervention effects were maintained for 3 months postintervention.

Conclusions. The Stanford Nutrition Action Program curriculum, tailored to the cultural, economic, and learning needs of low-literacy, low-income adults, was significantly more effective in achieving fat-related nutritional changes than the general nutrition curriculum. (*Am J Public Health.* 1997;87:1971–1976)

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Introduction

With the increasing diversity of Americans, many groups are at high risk for cardiovascular disease. One such group is the large population of adults with low literacy skills. It has been estimated that as many as 90 million or 48% of American adults have limited literacy abilities.¹ Although the impact of literacy on health in general, or on cardiovascular disease in particular, has received little investigation,^{2,3} literacy is likely to be a significant predictor of poor health and cardiovascular disease outcomes. Low literacy levels are positively correlated with lower education, income, and occupational status,¹ which are significant predictors of cardiovascular disease mortality and risk factors.^{4–10}

Few comprehensive nutrition programs for cardiovascular disease risk factor reduction have been developed specifically for adults with low literacy skills despite a growing awareness of the need for such programs. National programs such as the National Cholesterol Education Program and the American Heart Association Step 1 Diet have developed some materials with lower-grade reading levels, but providing comprehensive nutrition education for low-literacy adults is not the main purpose of either program. In 1991, the Stanford Nutrition Action Program (SNAP) was one of eight projects funded under a research initiative issued by the National Heart, Lung and Blood Institute to develop and test nutrition education methods and materials for English-speaking adults with low literacy skills. The primary objective of SNAP was to compare the effectiveness of two classroom-based nutrition curricula on lowering dietary fat intake. Although both curricula were designed for low-income populations, the SNAP curriculum targeted low-fat eating, used methods and materials

tailored for adults with low literacy skills, and incorporated principles of adult learning and social learning theory.^{11–17}

Methods

Design

A randomized design was used to test a classroom-based intervention that focused on lowering fat intake in an ethnically diverse population of adults with low literacy skills in San Jose, Calif. Twenty-four vocational training and general education degree classes were matched in pairs for class size and type of class. One of each pair was allocated randomly to receive either a newly developed curriculum that focused primarily on lowering dietary fat intake (SNAP) or an existing curriculum that focused on general nutrition.

Participants

Participants were recruited from six community sites; two were vocational training sites, three were general education sites, and one was mixed vocational/general education. The general nutrition curriculum had been offered regularly at these sites for several years and was integrated into the ongoing instruction at each site. In about half the sites, attendance in

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the nutrition course was mandatory; in the other sites, teachers encouraged their students to attend and gave them release time from other studies.

The SNAP Intervention

The SNAP intervention¹⁸ was conducted over 20 months from 1993 to 1994. It was composed of two parts: a 6-week, classroom-based intervention followed by a 12-week maintenance intervention. Its curriculum was developed to match the structure of the general nutrition classes, which typically had six 90-minute sessions. The curriculum was taught by one of two professional nutrition health educators and was organized into lessons that covered the major sources of dietary fat, including meat, dairy foods, desserts, snacks, and solid and liquid fats; the food guide pyramid; food label reading; and low-fat eating when away from home. Central to the lessons was the link between low-fat eating and the prevention of heart disease.

Each lesson emphasized interactive learning with few written materials. To make them culturally appropriate for the large number of Hispanic women who attended classes, lessons included ethnic foods and a discussion of the traditional nutrition habits of Hispanic women. Participants engaged in small- and large-group activities, interactive discussions, skill-building tasks, food tastings, and demonstrations.

Classes began with a review of the previous class and of the low-fat goals set by participants. This was followed by interactive activities, a review of tip sheets that summarized the major messages of the class, a discussion of recipes to identify low-fat strategies incorporated into the recipes, and an assessment of current eating practices (to help participants set a low-fat behavioral goal for the coming week). The goal-setting component of each lesson, which comprised about one fourth of the class time, was central to achieving behavioral change.

The 12-week maintenance intervention that followed the conclusion of the classroom intervention included contact with participants every 2 weeks either by telephone or by mail. These six contacts were structured to provide support and encouragement to participants to continue with low-fat eating; they did not introduce any new information. The three sets of mailed materials included a wallet-sized card with a simple low-fat message, a goal-setting postcard, a cue card identical to ones used in class, and one of the following

items: a colorful shopping notepad with a simple low-fat message; an audioteape and printed version of a rap song sung by the two SNAP teachers; or a "thank-you-from-your-heart" card, which restated five main messages taught in the curriculum and was signed by the SNAP staff. Telephone support calls lasted about 15 minutes. The calls followed a scripted format that assessed the types of low-fat eating that participants had been following since the previous contact, supported participants in their low-fat eating efforts, and helped participants to problem solve issues around and set new goals for low-fat eating. Support calls were made by the SNAP teachers and research assistants.

The General Nutrition Intervention

The general nutrition classes were taught by a paraprofessional nutrition educator working for the community-based Expanded Food and Nutrition Education Program, a program of the US Department of Agriculture and the Cooperative Extension Services of the University of California. The primary objectives of this program are to improve the knowledge and nutrition choices of low-income families and youth, with special emphasis on nutrition-related problems known to be most prevalent among low-income families from different ethnic groups. The general nutrition curriculum included five lessons on the food guide pyramid and one lesson on food safety and meal planning. A typical class involved didactic presentations, a review of class handouts and recipes, and the preparation of a recipe to taste in class. In our observation of one set of general nutrition classes, an average of 10% of each class was devoted to the topics of fat, blood cholesterol, or heart disease.

Data Collection

Data were collected at three times: at baseline, 1 week after completion of the SNAP curriculum (first follow-up), and 1 week following the 12-week maintenance intervention (second follow-up). There were approximately 5 months between baseline and the second follow-up. Questionnaires were developed for a fifth-grade or lower reading level and were administered in a group setting that allowed questions to be answered as needed. All questionnaire data were edited on site, and participants were asked to complete any missing items.

Literacy Assessment

Low literacy was defined as an eighth-grade or lower reading ability. The literacy level of participants at baseline was assessed with the use of the revised Wide-Range Achievement Test,¹⁹ the results of which are expressed as grade-level reading ability. This tool tests the reader's abilities in word recognition and pronunciation, and has been shown to have high validity and reliability.¹⁹ It consists of 74 words that increase in difficulty, beginning with *milk* and ending with *synecdoche*. Participants read each word out loud. For this study, the words were formatted onto six cards, which were handed to participants in sequential order to lessen any possible anxiety about seeing the entire list at once. Participants continued reading words until they had made 10 consecutive errors or pronounced all 74 words. All staff who administered the Wide-Range Achievement Test were trained until they scored 90% or better on pronunciation and practice tests and demonstrated their ability to administer the test. Each administrator was certified before the start of the study and again at midpoint in the study to ensure quality control.

Questionnaire Assessment

Participants answered a number of sociodemographic questions that were tailored to a low-literate, multiethnic population. Nutrition knowledge was assessed by 14 true/false statements testing the participants' knowledge of the material that was taught during the SNAP curriculum (e.g., "The protein in beans and rice is as good as the protein in a piece of meat"). Cronbach's alpha for this scale was .42.

Nutrition attitudes were measured by 18 items on a 5-point scale ranging from 1 = strongly disagree to 5 = strongly agree (Cronbach's alpha = .64). This scale included six themes that were emphasized throughout the SNAP intervention: attitudes toward the cost, taste, and preparation effort of low-fat foods; concerns about diet and health; attitudes about the appropriateness of low-fat diets for children; and family acceptance of low-fat foods.

Ten self-efficacy items measured the certainty with which participants felt they could perform a variety of behaviors, such as cutting down on the number of times they fried food each week and eating chicken without the skin. These self-efficacy items were measured on a 5-point scale with 1 = not at all certain and 5 = very certain (Cronbach's alpha = .76).

Dietary Assessment

The National Cancer Institute's 98-item Food Frequency Questionnaire was used to assess dietary habits and was self-administered.²⁰ This questionnaire has been validated in several studies²¹⁻²⁴ and has shown reasonable estimates of nutrient intakes. It consists of simple lists of foods from food groups and does not require high levels of reading ability. The questionnaire was modified to ask respondents to recall for the previous 2 weeks how often they consumed certain foods (range = never or less than once per week to 2+ per day) and in what size portions (small, medium, or large). The medium-size serving was defined for each food item (e.g., one-half cup of peas). The recall time period of the past 2 weeks was chosen because of the short-term nature of the intervention.

Items specific to Hispanic eating patterns supplemented the standard questionnaire to better capture Hispanics' food consumption patterns. Refried beans or bean burritos were added to the vegetable list and flour tortillas were added to the white bread item since they can both be a source of added fat in the diet. Other Hispanic-identified foods such as beef burritos, tacos, corn tortillas, red chili sauce, rice, chili with beans, and squash are standard on the questionnaire. Various supplemental questions (e.g., what types of fats are added to foods during cooking), most of which are usually added to the questionnaire, were included to better assess dietary fat intake.²⁰ Because classes were paired as to the time of assessment, seasonal variation between SNAP and the general nutrition classes was controlled.

Physiological Assessment

Capillary blood drawn by fingerstick and analyzed by the VISION portable autoanalyzer (Abbott Laboratories Inc, Irving, Tex) was used to measure total blood cholesterol in nonfasting participants. The VISION autoanalyzer has proven highly accurate compared with the standard venous cholesterol measurement techniques used in the standardized laboratories of the Centers for Disease Control²⁵ and was the most practical means of measuring cholesterol in our field settings. All staff who conducted the fingerstick tests were trained for a minimum of 10 hours and certified. The THINNER digital electronic scale was used to measure weight, which was taken without shoes and heavy garments and was recorded to the nearest half pound. The weight of a few participants

exceeded the scale's weight limit of 330 lb, so their weights were recorded at this upper limit. Height was measured to the nearest quarter inch with a metal tape measure attached to the wall.

Statistical Analyses

Classes, rather than individuals, were used as the unit of analysis for all descriptive statistical comparisons and for the primary dependent outcome measures. The analysis process followed from the experimental design, which involved pairing and then randomizing classes to conditions. Two-tailed, matched paired *t* tests were used to test the net change between SNAP and the general nutrition classes.

Results

Response Rates

A total of 351 participants attended the 24 classes that were randomized in the study. Seventy-nine percent of participants completed the baseline and first follow-up measurement; 69% completed all three measurements. Participants unavailable for follow-up measurements were most often from vocational training sites and had gained employment during the study. Missing data for cases were imputed from the participants' most recent measurement and assumed no change in outcome measures. A Cochran-Mantel-Haenszel statistical test indicated that there was no difference in attrition between SNAP and the general nutrition classes.

Participants

One hundred eighty-three participants attended the 12 SNAP classes (average = 15.2 participants per class) and 168 attended the 12 general nutrition classes (average = 14.0 participants per class). Analyses revealed no difference between the two groups of classes on any demographic characteristic at baseline (Table 1). The average grade-level reading ability across the two groups was 7.4; about 66% had a reading ability at the eighth-grade level or below. The majority of participants in both groups were young women, Hispanic, and born in the United States; in addition, most spoke English at home, lived in poverty, and had children under 18 living with them. Eighty-two percent of the Hispanic participants identified themselves as Mexican-American. Class attendance was high in both SNAP and the general nutrition classes. Of the 6

lessons per class, SNAP and general nutrition participants averaged 4.3 and 4.4 lessons per class, respectively.

Effects of the SNAP Curriculum Intervention

Net change score from baseline to first follow-up measures using two-tailed, matched paired *t* tests with class as the unit of analysis are shown in Table 2. On the questionnaire data, SNAP classes showed significantly greater improvements than general nutrition classes on nutrition knowledge, $t(11) = 4.93$, $P < .0004$; nutrition attitudes toward eating a low-fat diet, $t(11) = 2.87$, $P < .02$; and self-efficacy for achieving a low-fat diet, $t(11) = 2.28$, $P < .04$.

Food Frequency Questionnaire data showed significant changes in percentage of calories from total fat, $t(11) = -3.04$, $P < .01$, and saturated fat, $t(11) = -2.76$, $P < .01$ (Figure 1, baseline to first follow-up). Participants in both SNAP and general nutrition classes consumed fewer total and saturated fat calories at the first follow-up than at baseline; however, SNAP classes did not reduce their consumption significantly more than general nutrition classes did.

Also examined were changes in two physiological measures related to nutrition, neither of which was a direct focus of the intervention. Neither the body mass index nor total blood cholesterol measures showed significant differences. Both SNAP and general nutrition classes had relatively low total blood cholesterol levels at baseline and at the first follow-up.

Effects of the SNAP Maintenance

It was expected that the biweekly maintenance intervention would help SNAP classes maintain or improve the outcomes achieved as the result of the program's curriculum intervention. In contrast, the general nutrition classes that received no maintenance intervention were expected to maintain or decline in their outcomes, leading to an overall net change in favor of the SNAP classes. However, no significant differences in the net change from first follow-up to second follow-up measures were found, as shown in Table 3. It appears that both groups of classes maintained the level of change achieved from their respective curricula on most outcomes. For example, as shown in Figure 1, from first follow-up to second follow-up, both SNAP and the general nutrition classes appear to have maintained their lower levels of percentage of calories from total and saturated fat.

TABLE 1—Baseline Literacy and Demographic Characteristics by Treatment Group,^a San Jose, California, 1993–1994

	Treatment Group	
	Stanford Nutrition Action Program Classes (n = 12)	General Nutrition Classes (n = 12)
No. participants	183	168
Reading ability, %		
0–4th grade	18	18
5–6th grade	21	23
7–8th grade	24	28
9–12th grade	28	19
>12th grade	8	12
Sex, % women	86	82
Mean age, y	31 ± 2.5	31 ± 3.0
Education, %		
≤ 8 y	6	4
9–11 y	38	36
12 y	34	36
≥ 12 y	21	24
Ethnicity, %		
Asian	10	13
Hispanic	58	59
White, non-Hispanic	20	15
Other	12	12
Place of birth, %		
United States	73	70
Mexico	16	15
Other	11	14
Years lived in United States, mean	25 ± 3.6	24 ± 4.0
English spoken at home, %	81	84
Family income <\$10,000/y, %	63	66
Marital status, %		
Never married	41	42
Currently married	22	19
Other	37	38
Children under 18 y living at home, %	87	83

^aIn conducting comparisons, the class was used as the unit of analysis. There were no significant differences between the groups for any characteristic at the $P < .05$ level.

Discussion

These results indicate that SNAP's nutrition education curriculum, developed and implemented for low-income, low-literacy adults, was significantly more effective in achieving fat-related nutritional changes than was a strong alternative general nutrition curriculum. These effects were found despite wide variance in people's dietary intake and a small number of randomized classes. While the general nutrition curriculum may have shown equal or better improvements on components not evaluated by this analysis (e.g., knowledge of food groups, daily nutrient requirements, food safety), the results show significant gains for SNAP participants in fat-related nutrition knowledge, attitudes, self-efficacy, and percentage of calories from total and saturated fat (which they reduced over a 5-month period from 37.1% to 33.2% and from 13.3% to 11.9%, respectively). And while both groups of classes reduced their total daily calories by more than 300 over the course of the study, SNAP classes apparently made better choices than general nutrition classes about how their calories were distributed by selecting lower-fat foods. These results are generalizable to other populations of low-literacy adults attending vocational and basic skills education classes.

Data from the 1988–1991 National Health and Nutrition Examination Survey for the general population showed the percentage of calories for total fat at 34% and for saturated fat at 12%, which is lower than those percentages reported at baseline by participants in this study.²⁶ The higher baseline fat intake in our participants may reflect their lower socioeconomic and literacy sta-

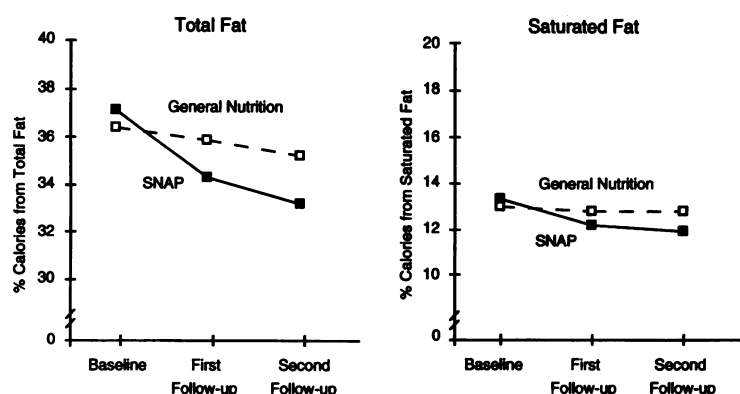
TABLE 2—Change in Nutrition-Related Outcomes Following Curriculum Intervention^a

	Stanford Nutrition Action Program Classes (n = 12)			General Nutrition Classes (n = 12)			Net Change	P
	Baseline	First Follow-up ^b	Change	Baseline	First Follow-up ^b	Change		
Nutrition knowledge, % correct	57.0 (4.8)	66.6 (4.5)	+9.6 (4.0)	55.8 (3.0)	57.7 (3.7)	+1.9 (4.1)	+7.7 (5.4)	.01
Nutrition attitudes, mean (range 1–5)	3.5 (0.1)	3.8 (0.1)	+0.3 (0.1)	3.5 (0.2)	3.6 (0.2)	+0.1 (0.1)	+0.2 (0.2)	.02
Nutrition self-efficacy, mean (range 1–5)	3.8 (0.1)	4.1 (0.2)	+0.3 (0.2)	3.8 (0.2)	3.9 (0.2)	+0.1 (0.2)	+0.2 (0.3)	.04
Total dietary fat, g/d	84.1 (10.7)	63.2 (9.9)	−20.9 (9.8)	85.1 (23.2)	71.8 (16.9)	−13.3 (13.2)	−7.6 (19.2)	.20
Total saturated fat, g/d	30.7 (4.1)	22.9 (4.1)	−7.8 (3.8)	31.0 (9.4)	26.1 (6.4)	−4.9 (5.3)	−2.9 (7.5)	.21
Calories from total fat, %	37.1 (1.7)	34.3 (2.4)	−2.8 (2.4)	36.4 (3.0)	35.9 (2.8)	−0.5 (2.0)	−2.3 (2.6)	.01
Calories from saturated fat, %	13.3 (0.6)	12.2 (0.9)	−1.1 (0.9)	13.0 (1.4)	12.8 (1.2)	−0.2 (0.7)	−0.9 (1.2)	.02
Body mass index	29.7 (2.8)	29.7 (2.8)	0.0 (0.2)	27.2 (1.7)	27.2 (1.8)	0.0 (0.2)	0.0 (0.1)	.18
Blood cholesterol, mg/dL	179.4 (13.2)	178.1 (7.0)	−1.3 (9.3)	182.7 (17.8)	181.8 (14.8)	−0.9 (9.2)	−0.4 (6.7)	.87

Note. Standard deviations are shown in parentheses.

^aTwo-tailed, matched paired *t* tests were conducted on the net change data, using class as the unit of analysis.

^bFirst follow-up measures were taken 1 week after the curriculum intervention, 2 months after baseline.



Note. SNAP = Stanford Nutrition Action Program.

FIGURE 1—Percentage of calories from total and saturated fat in treatment groups at baseline and follow-up measurements.

tus as compared with that of the general US population, highlighting the need for interventions developed specifically for this population.²⁷ While our study found significant net reductions in the percentages of calories from total and saturated fat, these data indicate that more needs to be done to achieve the *Healthy People 2000* goals ($\leq 30\%$ of calories from total fat and $\leq 10\%$ of calories from saturated fat). Perhaps a longer classroom intervention or longer follow-up period would have achieved these goals in the study population.

While the curriculum showed significant results for dietary reductions in fat intake, two physiological measures, neither of which was a primary outcome measure of the study, showed no change. Finding no changes in body mass index is not sur-

prising, given that SNAP emphasized eating less fat but not necessarily fewer calories, did not mention exercise, and only peripherally noted the potential weight benefits that dietary fat reduction might achieve. Blood cholesterol showed a steady downward pattern over time for SNAP classes, while that for the general nutrition classes stayed level. None of the class comparisons showed a stronger cholesterol effect for the SNAP intervention at any measurement period, however. Possible explanations for the lack of significant effects for blood cholesterol include the low baseline cholesterol level; the SNAP program goal of stimulating moderate, gradual reductions in fat intake; and the short-term nature of the intervention.

In this study, we examined the effects of 12 weeks of maintenance on outcomes.

During maintenance, participants received six contacts via phone and mail to support their commitment to low-fat eating. While we did not see significant net change effects, it appeared that both groups of participants maintained the changes achieved as a result of their respective curricula. The study design does not allow us to assess separately the effects of the SNAP curriculum from the added effects of the SNAP maintenance; however, other research has suggested that minimal-contact follow-up support is important for the maintenance of new skills and behavioral changes.²⁸⁻³² It may be that SNAP's maintenance intervention was important in helping participants maintain the high level of changes achieved during the curriculum intervention.

In summary, there is an enormous need for appropriate health education materials for the millions of low-literacy adults in the United States. Several recent reviews have noted the paucity of health materials written for audiences with low literacy levels.³³⁻³⁷ Materials designed for these populations will find many outlets for their distribution and use. Various community-based programs, such as library literacy education programs, services for the poor and homeless, and preschool parenting classes, are currently serving large numbers of low-literacy adults. As more health professionals become sensitized to the unmet needs of this population, health and community services will seek high-quality materials that target it. SNAP is one of several research projects funded by the National Heart, Lung and Blood Institute in recent years to develop and evaluate nutrition education programs for low-literacy adults. Its curriculum, along with that of many other

TABLE 3—Change in Nutrition-Related Outcomes Following Maintenance Intervention^a

	Stanford Nutrition Action Program Classes (n = 12)			General Nutrition Classes (n = 12)			Net Change	P
	First Follow-up ^b	Second Follow-up ^c	Change	First Follow-up ^b	Second Follow-up ^c	Change		
Nutrition knowledge, % correct	66.6 (4.5)	66.2 (4.7)	-0.4 (1.9)	57.7 (3.7)	56.8 (2.5)	-0.9 (2.8)	+0.5 (2.8)	.52
Nutrition attitudes, mean (range 1-5)	3.8 (0.1)	3.8 (0.2)	0.0 (0.1)	3.6 (0.2)	3.6 (0.2)	0.0 (0.1)	0.0 (0.2)	.97
Nutrition self-efficacy, mean (range 1-5)	4.1 (0.2)	4.1 (0.2)	0.0 (0.1)	3.9 (0.2)	3.8 (0.2)	-0.1 (0.2)	+0.1 (0.2)	.26
Total dietary fat, g/d	63.2 (9.9)	64.0 (14.8)	+0.8 (11.9)	71.8 (16.9)	68.1 (14.3)	-3.7 (11.2)	+4.5 (17.4)	.39
Total saturated fat, g/d	22.9 (4.1)	23.4 (5.6)	+0.5 (4.7)	26.1 (6.4)	25.1 (5.0)	-1.0 (4.5)	+1.5 (6.7)	.44
Calories from total fat, %	34.3 (2.4)	33.2 (3.0)	-1.1 (1.9)	35.9 (2.8)	35.2 (3.4)	-0.7 (2.1)	-0.4 (2.4)	.56
Calories from saturated fat, %	12.2 (0.9)	11.9 (1.2)	-0.3 (0.7)	12.8 (1.2)	12.8 (1.2)	0.0 (0.9)	-0.3 (1.0)	.45
Body mass index	29.7 (2.8)	29.7 (2.7)	0.0 (0.2)	27.2 (1.8)	27.2 (1.8)	0.0 (0.1)	0.0 (0.2)	.94
Blood cholesterol, mg/dL	178.1 (7.0)	176.9 (11.8)	-1.2 (6.9)	181.8 (14.8)	182.5 (17.4)	+0.7 (5.8)	-1.9 (7.4)	.37

Note. Standard deviations are shown in parentheses.

^aTwo-tailed, matched paired *t* tests were conducted on the net change data, using class as the unit of analysis.

^bFirst follow-up measures were taken 1 week after the curriculum intervention, 2 months after baseline.

^cSecond follow-up measures were taken 1 week after the maintenance intervention, 3 months after the first follow-up.

programs, is currently available to the health community and has made a substantial contribution to addressing the needs for appropriate and effective nutrition programs for low-literacy adults. □

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